Example:

How many milliliters of 6.00M hydrochloric acid is needed to completely react with 25.0 g of sodium carbonate?

$$2HCl(aq) + Na_2CO_3(s) \longrightarrow H_2O(l) + CO_2(g) + 2NaCl(aq)$$

1 - Convert 25.0 g sodium carbonate to moles using formula weight.
2 - Convert moles sodium carbonate to moles hydrochloric acid using chemical equation.
3 - Convert moles hydrochloric acid to volume using concentration (6.00 mol/L)

$Na_2CO_3$ : Na: $2 \times 22.99$
C: $1 \times 12.01$
O: $3 \times 16.00$

$105.99\ g\ Na_2CO_3 = mol\ Na_2CO_3$

① $25.0\ g\ Na_2CO_3 \times \frac{mol\ Na_2CO_3}{105.99\ g\ Na_2CO_3} = 0.2358713086\ mol\ Na_2CO_3$

$2\ mol\ HCl = mol\ Na_2CO_3$

② $0.2358713086\ mol\ Na_2CO_3 \times \frac{2\ mol\ HCl}{mol\ Na_2CO_3} = 0.4717426172\ mol\ HCl$

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$6.00\ mol\ HCl = L$ $\quad mL = 10^{-3} L$

③ $0.4717426172\ mol\ HCl \times \frac{L}{6.00\ mol\ HCl} \times \frac{mL}{10^{-3} L} =$ **78.6 mL of 6.00 M HCl**

You can solve the problem on one line if you want:

$105.99\ g\ Na_2CO_3 = mol\ Na_2CO_3$ $\quad 2\ mol\ HCl = mol\ Na_2CO_3$

$6.00\ mol\ HCl = L$ $\quad mL = 10^{-3} L$

$$25.0\ g\ Na_2CO_3 \times \underbrace{\frac{mol\ Na_2CO_3}{105.99\ g\ Na_2CO_3}}_{①} \times \underbrace{\frac{2\ mol\ HCl}{mol\ Na_2CO_3}}_{②} \times \underbrace{\frac{L}{6.00\ mol\ HCl} \times \frac{mL}{10^{-3} L}}_{③} =$$

$$= 78.6\ mL$$

EXAMPLE PROBLEM:

$$2\,Na(s) + Cl_2(g) \rightarrow 2\,NaCl(s)$$

How many grams of sodium metal is required to completely react with 2545 grams of chlorine gas?

1 - Convert 2545 g of chlorine gas to moles. Use formula weight of chlorine gas.
2 - Convert moles chlorine gas to moles sodium using chemical equation.
3 - Convert moles sodium to mass sodium using formula weight of sodium.

① $Cl_2$: $2 \times 35.45 = 70.90\ g\ Cl_2 = mol\ Cl_2$ | ② $2\ mol\ Na = mol\ Cl_2$

③ Na: $22.99\ g\ Na = mol\ Na$

$$2545\ g\ Cl_2 \times \underset{①}{\frac{mol\ Cl_2}{70.90\ g\ Cl_2}} \times \underset{②}{\frac{2\ mol\ Na}{mol\ Cl_2}} \times \underset{③}{\frac{22.99\ g\ Na}{mol\ Na}} = \boxed{1650.\ g\ Na}$$